Perceptions, Utilization, and Training of Graduate Student Teaching Assistants in Introductory Soil Science Courses: Survey Results[1]

Greg D. Pillar[2]
Queens University of Charlotte
Charlotte, NC 28274

Keith J. Karnok[3]
University of Georgia
Athens, GA 30602

Steve J. Thien[4]
Kansas State University
Manhattan, KS 66506

Abstract

Most colleges of agriculture in land grant institutions offer an introductory soil science course. While structure and content of these courses varies considerably, most utilize graduate students as teaching assistants. In the fall of 2005, we sought to characterize the teaching experience of graduate students in introductory soil science courses through an online survey sent to 52 universities offering an introductory soil science course. The survey was designed to determine how graduate students perceive their teaching responsibilities, determine what their teaching responsibilities entail, and how they were prepared for their teaching assignment. Seventy-seven surveys representing 40 (77%) universities were completed by graduate students at both the M.S. and Ph.D. level. Overall, the respondents held an overall positive view of their teaching experience. When asked how their teaching experience impacted their graduate education, 89% agreed their experience improved their knowledge and understanding of material in their field of study. However, 40% of the respondents indicated that their teaching responsibilities impeded their ability to conduct research. Although graduate students are widely used for a variety of teaching duties, 45% of the students reported having no structured training in college instruction, before or during their teaching experience. Overall, we feel these results illustrate the significance of incorporating college teaching into the development and education of graduate students.

Introduction

The demand to publish and sustain viable research programs at large research universities has resulted in full time faculty spending less time in the classroom and more time conducting research or instructing graduate students (C.J. Sykes, 1988; Boyer 1990; Campbell et al., 2005). Additionally, the increasing student population at colleges and universities across the country has led to an increase in course offerings and the need for more instructors to teach these courses (NCES, 2007). As a result, graduate students are being utilized as primary instructors or are taking on greater responsibilities as graduate student teaching assistants (GTAs) in the classroom (Travers, 1989; Bomotti, 1994; Campbell et al., 2005).

Although research is the major focus of faculty at most large research universities, teaching is still a significant work activity. According to the Carnegie Foundation there are 282 universities (6.4% of all universities) classified as large research universities that offer doctoral programs (Carnegie Foundation, 2007). In a 2004 survey conducted by the U.S. Department of Education, 48.6% to 51.6% of full-time faculty at these universities reported teaching as their principal work activity (NCES, 2007). These programs are the gate-keepers with respect to preparing faculty who will be employed in teaching positions at smaller colleges offering master's degrees (665 institutions, 15.1%) and baccalaureate degrees (765 institutions, 17.4%; Carnegie Foundation, 2007). In contrast, more than 80% of full-time faculty at these smaller universities reported teaching as their principal work activity and less than 2% of faculty at these institutions (public and private) reported research as a principle work activity (NCES, 2007). Additionally, there are 1811 (41.4%) 2-year institutions where teaching is a principal work activity and 63.2% of full-time faculty hold a masters degree and 18.8% hold a doctorate or professional degree (Carnegie Foundation, 2007; NCES, 2007). In

[1]Acknowledgements: We thank Dr. Jessica Braswell, Dept. of Environmental Science at Queens Univ. of Charlotte, Dr. Melinda Harper, Dept. of Psychology at Queens Univ. of Charlotte, and anonymous reviewers for comments and suggestions on the manuscript.
[2]Assistant Professor, Departments of Environmental Science and Chemistry, 1900 Selwyn Ave; Tel: 704.337.2260; Email: pillarg@queens.edu
[3]Professor, Department of Crop and Soil Sciences, 3111 Miller Plant Sciences
[4]Professor, Department of Agronomy, 2004 Throckmorton Plant Sciences

a national survey of 1440 doctoral students, 71% indicated a desire to teach in higher education (Anderson and Swazey, 1998). Based on these statistics, one would expect the development of teaching skills to be a significant component and/or goal of graduate education. However, despite this interest in teaching and the need for well trained professional teachers, research has become a major focus of graduate assistantships and education while teaching activities often become a secondary endeavor (Shannon et al., 1998; Campbell et al., 2005).

The common research-orientated approach to graduate education involves students taking classes and conducting research under the guidance of their advisor who is a trained and experienced scientist. This practice of a research facilitated graduate education has recently come under scrutiny by a number of studies and publications as being insufficient in preparing graduate students for the diverse array of jobs they may pursue and the attendant requirements they will encounter (Nerad and Cerny, 1999; Golde and Dore, 2001; Adams, 2002; Luft et al., 2004; Nyquist et al. 2004, Campbell et al., 2005). Among the shortcomings of the current graduate education system discussed are a lack of broader training and skill development in teaching, communication, and general interdisciplinary experience. In a report by the Association of American Colleges and Universities (AACU, 1985, p. 29) it was stated, *"If the professional preparation of doctors were as minimal as that of college teachers, the United States would have more funeral directors than lawyers."* Since the 1985 AACU report there have been a variety of suggestions and proposed methods to improve the development of teaching skills including mentoring programs, partnerships with K-12 school systems, establishment of centers for teaching and learning on college campuses, and the institution of reward systems recognizing participation in GTA training programs (Fairweather and Rhoads, 1995; Sharpe, 2000; Gaia et al., 2003; Luft et al., 2004; Trautmann and Krasny, 2006).

While there have been studies focused on the development and experience of graduate students as teachers (Bomotti, 1994; Anderson and Swazey, 1998; Shannon et al., 1998; Luft et al., 2004), very little work has focused on graduate students in specific fields or disciplines such as soil science or agronomy. Thus, the overarching goal of this study was to characterize the teaching experience of graduate students in introductory soil science courses. To achieve this goal a survey was designed with the following specific objectives: (i) determine the teaching responsibilities of graduate students in introductory soil science courses at institutions offering B.S. degrees in soil science or related degrees; (ii) obtain information on how graduate students were trained and prepared for their teaching responsibilities; and (iii) assess the perceptions and general attitudes of graduate students towards their teaching experience.

Methods

Survey Construction and Disbursement

To obtain information on graduate student perceptions and experiences in teaching a web based survey was constructed and delivered using Zoomerang, a third party website (http://info.zoomerang.com/). Survey responses were received and monitored electronically between October 2005 and January 2006. The survey contained 42 questions separated into four sections. The first section consisted of multiple choice and open-answer questions to obtain the participants' demographics and background information. The second and third sections consisted of multiple choice and Likert-type questions designed to assess the participants' teaching responsibilities and training, respectively. The final section consisted of Likert-type statements and two open-answer questions inquiring about the participant's perception of and general experience in teaching. Open-answer questions were kept to a minimum to avoid repetitious or irrelevant material (Sheatsley, 1983).

Faculty members at 52 universities (public and private) who were responsible for teaching an introductory soil science course were first contacted by phone to determine if graduate students were involved in the course and held teaching responsibilities in either the lab and/or lecture component(s) of the course. The phone call was followed by a letter sent electronically to the same faculty members soliciting their assistance in asking their graduate student teaching assistants to complete the online survey. Two follow-up e-mail messages were sent to faculty to encourage their students to complete the survey. To simplify the interpretation of the results, only graduate students who had teaching responsibilities in an introductory soil science course within the last year were asked to complete the survey.

Statistical Analysis

Data were analyzed using SPSS Ver. 15 to determine frequencies, relative sample abundances, means, ranges, and standard deviations. For some questions, respondents were asked to rate their involvement in certain teaching activities on a Likert-scale from 1 to 3, with 1 being not involved, 2 being involved, and 3 being very involved. For these questions, average responses ≥ 2.5 were considered to mean very involved and ≤ 1.5 were considered to mean little to no involvement. For other Likert-type questions, participants were asked to rate their agreement with statements on a scale from 1 to 5, with 1 being strongly disagree and 5 being strongly agree. For these questions, responses < 3 were considered negative and ≥ 3 were considered positive.

Results and Discussion

Survey Response Rate, Demographics and Background

A total of 77 individual responses were received representing 40 universities (Table 1). Six of the 12 universities that did not respond to the survey did not utilize graduate students as teaching assistants in their course. The average age of the graduate students surveyed was 28.3 years old (S.D. ±5.2) with a range between 23 and 50 years old. Sixty-two percent of the respondents were male and 91% were U.S. citizens. Sixty-four percent of the respondents were pursuing a M.S. degree while the remaining 36% were pursuing a Ph.D. Although the survey focused on graduate students with teaching responsibilities associated with an introductory soil science course only 85% of the respondents stated their area of study was soil science or a closely related field (i.e. soil chemistry, soil physics, etc). The other 15% was comprised of students majoring in fields such as range management, environmental science, turfgrass management, agricultural education, and forest resources. The manner in which graduate students became involved in their teaching responsibilities varied, as 60.3% reported they were on a teaching assistantship, 24.4% stated they had volunteered, 10.3% were meeting a department or university teaching requirement (and not on an assistantship), and the remaining 5.1% reported other reasons.

Table 1. Universities represented by graduate students participating in a survey of graduate student teaching assistants in introductory soil science courses

North Central Region		Northeastern Region
University of Minnesota		University of New Hampshire
Purdue University		Cornell University
Kansas State University		Pennsylvania State University
University of Nebraska		West Virginia University
Ohio State University		Virginia Tech
North Illinois University		University of Delaware
		University of Vermont
		University of Maryland
		Syracuse University
		Johnson State College
Southern Region		**Western Region**
Auburn University		University of Arizona
Alabama A&M University		University of California – Davis
University of Arkansas		University of California – Berkley
University of Georgia		Colorado State University
University of Florida		Montana State University
Oklahoma State University		University of Nevada
Louisiana State University		New Mexico State University
Mississippi State University		University of Wyoming
North Carolina State University		Oregon State University
Clemson University		University of Idaho
University of Tennessee		University of Washington
Texas A&M University		
Tartleton University		

Graduate Student Roles and Responsibilities

One of the objectives of this study was to determine how graduate students with teaching responsibilities in an introductory soil science course were being utilized in the classroom and/or laboratory. The specific responsibilities graduate students are given may be determined in part by the structure of the course, the instructor of record, the department, college, and/or university. Understanding the specific roles graduate students are assigned in the classroom is important in order to determine their preparedness and teaching philosophy as they prepare for potential careers in teaching.

Historically, the experience and degree level (i.e. M.S. vs Ph.D.) of graduate students will often determine the degree of responsibility given in the classroom and/or lab. It is not uncommon for M.S. students to be utilized as teaching assistants in freshmen/sophomore level courses such as introduction to soil science (Luft et al., 2004). Doctoral students are usually more focused on research activities and if they do have teaching responsibilities it is often within their first two years of pursuing their Ph.D. and/or their teaching responsibilities are associated with upper level undergraduate or graduate courses (Luft et al., 2004). The results of this study support these findings, as 42% of the graduate students surveyed had been in graduate school for less than two years and 77% had been in graduate school for less than four years. This reflects the high percentage of M.S. students (64%) who responded to the survey as well as the notion that Ph.D. students are involved in teaching within their first two to three years as they complete their course work and before they become involved in their dissertation research.

Science courses are often broken down into two parts: a classroom component and a laboratory component. To determine how graduate students are utilized in introductory soil science courses, respondents were asked to rate their involvement in various teaching activities using a Likert-scale (1 – non involved, 2 – involved, 3 – very involved) in the classroom, laboratory, or both depending on their individual responsibilities. Almost all of the respondents (97.4%, n = 77) stated that they had some teaching responsibilities in the laboratory component of the course, whereas less than half (46.8%, n = 77) stated they had teaching responsibilities in the classroom component of the course. Of the 11 lab activities that were surveyed, graduate students reported they were very involved (> 2.50) in grading assignments (2.89 ± 0.39), grading quizzes (2.83 ± 0.50), giving a presentation using the instructors notes (2.79 ± 0.45), lab preparation/set-up (2.72 ± 0.53), developing and giving a presentation (2.61 ± 0.64), and grading a test (2.51 ± 0.83; Table 2). Although there were no activities for which graduate students reported no involvement (< 1.5), students reported that they were not as involved in developing a lab exercise (1.71 ± 0.78), developing an assignment (1.75 ± 0.84), and writing lab objectives/syllabi (1.77 ± 0.86). Of the nine classroom activities that were surveyed, graduate

students reported they were very involved in grading a quiz (2.51 ± 0.78) and grading an assignment (2.50 ± 0.77). Additionally, graduate students reported little to no involvement (< 1.50) in writing objectives/syllabi for the course (1.44 ± 0.65; Table 3). These results indicate that graduate students are largely responsible for activities that neither require nor develop much if any teaching experience. Interestingly, when participants were asked to state what they disliked about their teaching experience, 17% made reference to activities involving grading.

When comparing master students to doctoral students additional trends were evident, however, not statistically significant. Doctoral students appear to be more involved in writing/objectives/syllabi, developing/writing an assignment and developing an experiment for lab than master students (Table 2). Doctoral students also appear to be more involved in writing objectives/syllabi, developing/writing an assignment and developing a presentation for lecture compared to master students (Table 3). This indicates that doctoral students typically are given greater teaching responsibilities requiring greater effort, preparation, and experience. This is not unwarranted as many doctoral students have obtained some teaching experience while obtaining their M.S. degree and many are preparing for careers in academia where they could have significant teaching responsibilities.

Training and Preparation

Graduate students were asked if they received formal training in teaching (i.e. teaching techniques/strategies, how to write quiz/test questions, how to prepare a syllabus, etc.) by the university, college, department, or individual faculty members before or during their teaching experience. Only 23% (n = 77) of the respondents received training before their teaching experience and 49% (n = 75) reported they received training during their teaching experience. Of all the graduate students surveyed, 45% received no training before or during their teaching experience. These results are similar to those of a national survey of TAs that found only 53% received some form of training (Gray and Buerkel-Rothfuss, 1991). Interestingly, 86% (n = 35) of the students in the current study who received no training reported they were either prepared or very prepared to handle their teaching responsibilities. This high degree of confidence despite receiving no training may be due to the nature of the teaching responsibilities (i.e. grading, lab preparation) or a result of students receiving training outside of their college or university (i.e. professional meetings, workshops, seminars). Previous studies have noted that inexperienced teachers hold a higher level of self-efficacy with regards to teaching compared to those with a small amount of teaching experience (Dembo and Gibson, 1985; Evans and Tribble, 1986; Prieto and Altmaier, 1994). However, with time, student's level of efficacy increased as they gained more experience and received further training. The explanation for this phenomenon is that students tend to have an inflated perceived efficacy until they

Table 2. Graduate student involvement in various teaching activities associated with the laboratory portion of an introductory soil science course

	Overall[z]		Ph.D.		M.S.	
Laboratory Activity[y]	Avg	SD	Avg	SD	Avg	SD
Grading an assignment	2.89	0.39	2.88	0.33	2.89	0.43
Grading a quiz	2.83	0.50	2.88	0.34	2.81	0.57
Giving a presentation in lab	2.79	0.45	2.83	0.48	2.76	0.43
Setting up/preparing lab exercises	2.72	0.53	2.81	0.48	2.67	0.56
Developing a presentation for lab	2.61	0.64	2.77	0.51	2.52	0.68
Grading a test	2.51	0.83	2.71	0.62	2.40	0.90
Developing/writing a quiz	2.29	0.86	2.48	0.71	2.19	0.92
Developing/writing a test	1.82	0.84	2.08	0.78	1.69	0.85
Writing objectives/syllabi for a laboratory section	1.77	0.86	2.12	0.91	1.57	0.77
Developing/writing an assignment	1.75	0.84	2.08	0.88	1.57	0.77
Developing a lab exercise	1.71	0.78	2.11	0.75	1.48	0.71

[z] N = 75 overall; N = 27 for Ph.D. students; N = 48 for M.S. students.
[y] 1 = not involved to 3 = very involved

Table 3. Graduate student involvement in various teaching activities associated with the lecture portion of an introductory soil science course

	Overall[z]		Ph.D.		M.S.	
Lecture Activity[y]	Avg	SD	Avg	SD	Avg	SD
Grading a quiz	2.51	0.78	2.50	0.76	2.52	0.81
Grading an assignment	2.50	0.77	2.57	0.65	2.45	0.86
Grading a test	2.44	0.81	2.43	0.76	2.45	0.86
Developing/writing a quiz	2.09	0.78	2.31	0.63	1.95	0.84
Giving a presentation in lecture	1.97	0.83	2.20	0.77	1.82	0.85
Developing a lecture	1.86	0.75	2.20	0.77	1.64	0.66
Developing/writing a test	1.86	0.76	2.14	0.66	1.68	0.78
Developing/writing an assignment	1.64	0.76	2.14	0.66	1.32	0.65
Writing objectives/syllabi for a lecture course	1.44	0.65	1.93	0.73	1.14	0.35

[z] N = 36 overall; N = 14 for Ph.D. students; N = 22 for M.S. students.
[y] 1 = not involved to 3 = very involved

obtain experience dealing with real performance issues and accomplishments (Dembo and Gibson, 1985; Evans and Tribble, 1986; Golde and Dore, 2001).

Of the graduate students who reported receiving training prior to their teaching experience 56% (n = 18) received less than six hours of training while 28% received more than ten hours of training. In a national survey of TAs Gray and Buerkel-Rothfuss (1991) revealed that 75% of students who received training received less than one week. Seminars (67%) and workshops (61%) were the most common methods used to facilitate graduate student training in teaching. When asked who offered and/or organized the training, 50% reported the training was organized by their respective university. Although no data or information was collected regarding the topics and material covered during these training sessions, previous studies have shown that training offered at the University level usually do not cover pedagogy but rather general classroom policies and procedures (Carroll, 1980; Gray and Buerkel-Rothfuss, 1991; Rushin et al., 1997; Shannon et al., 1998; Luft et al., 2004). However, 94% of the respondents who received training prior to their teaching experience felt the training was useful or extremely useful and only 39% felt they needed additional training. Similarly, in a national survey of more than 32,000 doctoral students, 45% felt they did not receive adequate training before entering the classroom (NAGPS, 2001). Learning how to teach is a complicated and multifaceted process that requires sufficient training, practice, and patience (Anderson and Mitchener, 1994; Thien, 2003). However, the research driven nature of many graduate programs does not provide sufficient time and resources to develop skills in addition to those needed to conduct research (Luft et al., 2004). Although the graduate students who participated in this survey largely felt prepared for their teaching responsibilities, the results do suggest that further pedagogical training that draws on discipline-specific research and literature should be considered in order to better prepare graduate students for future teaching activities.

The successful development of the skills needed for an academic career in teaching require a mixture of discipline specific training and instruction in pedagogy (Hammrich, 2001). Additional questions were asked to determine if students took initiative to improve their teaching pedagogy. Forty percent (n = 75) reported they sought out training/instruction on teaching methods/pedagogy from faculty. Additionally, 62% (n = 76) attended workshops/seminars and 51% reported reading books or journal articles on topics related to teaching and learning (Table 4). The high level of self-motivation to seek opportunities to improve teaching and teaching related skills is further evidence of the need for training and development of skills other than conducting research. Previous studies have reported that graduate students work independently and receive little feedback from experienced faculty on their teaching (Rushin et al., 1997; Luft et al., 2004). In this study 58% reported they have had another graduate student or faculty member observe and provide feedback on their teaching techniques. Traditionally the main mechanism in which graduate students receive feedback on their teaching is from their students through mid-semester or end of the semester teaching evaluations (Luft et al., 2004). In this study, 66.7% of the graduate students reported that end of the semester student evaluations were conducted to evaluate their teaching and only 6.4% (n = 5) reported that mid-semester evaluations were conducted. Graduate students felt that the mid-semester (100%) and end of the semester (92.3%) student evaluations were useful or extremely useful as feedback tools to improve their teaching.

Teaching portfolios including a teaching philosophy statement have been shown to be important and useful tools to not only improve teaching but as a measure of teaching excellence used in hiring and are also utilized in promotion and tenure decisions (Seldin, 1998; Schönwetter, et al. 2002). Forty-seven percent of the graduate students surveyed stated that they maintained a teaching portfolio defined as a collection of documents such as samples of student work, teaching materials, description of courses taught, etc. However, only 35% reported that they had written a teaching philosophy statement which is often the main component of a teaching portfolio. Fifty- seven percent of doctoral students stated they

Table 4. Graduate students response to survey questions regarding their motivation to improve and develop their teaching skills

	Overall[z]		Ph.D.		M.S.	
	Yes	No	Yes	No	Yes	No
			--- % ---			
Have you attended workshops/seminars on teaching and/or learning?	62	38	57	43	65	35
Have you sought training on teaching techniques from faculty?	40	60	52	48	33	67
Have you had another graduate student or faculty member observe your teaching?	58	42	68	32	52	48
Have you read books/journal articles on teaching and/or learning?	51	49	68	32	42	58
Do you have a teaching philosophy statement?	35	65	57	43	22	78
Do you have a teaching portfolio?	47	53	68	32	36	64

[z] N = 76 overall; N = 28 for Ph.D. students; N = 48 for M.S. students.

had a teaching philosophy statement compared to 22% of M.S. students. The difference between Ph.D. and M.S. students who have a teaching philosophy statement may be due in part to the development of Ph.D. students as future teachers and faculty. Interestingly, of all the students surveyed who stated they had a teaching portfolio and teaching philosophy statement 73% and 74% reported that they had received training either before or during their teaching experience, respectively.

Graduate Student Perceptions

Various studies have reported that teaching is perceived to be of less importance at large, research universities by faculty and graduate students (Golde and Dore, 2001; Adams, 2002; Austin and Wulff, 2004; Luft et al., 2004). In this survey, GTAs were asked a variety of Likert-scale questions regarding their views of teaching, their teaching environment, and of their teaching experience. Overwhelmingly, graduate students had a positive perception of teaching and of their teaching experience (Table 5 and Figure 1). Ninety-three percent of the students surveyed (4.17 ± 0.89) stated they were interested in teaching. Although not significant, doctoral students expressed a greater interest (4.54 ± 0.64) in teaching compared to master students (3.96 ± 0.96). This presents the possibility of bias in interpretation of students' perceptions of their teaching experience as most of those surveyed were already interested in teaching and therefore may already value the benefits of obtaining teaching experience. In general, students rated their advisor (4.05 ± 0.86), department (3.38 ± 1.06), and university (3.42 ± 1.01) as being supportive of their teaching interests/activities, which contradicts others who have reported that students felt they received little to no support in their teaching interests (Bomotti, 1994; Luft et al., 2004; Table 5).

When asked how their teaching experience has impacted their graduate education the survey participants felt teaching had a positive impact on their education and life. Students strongly agreed that their teaching experience gave them a new appreciation for teaching (4.49 ± 0.55), enhanced their public speaking skills (4.34 ± 0.64), and improved their knowledge and understanding of subjects in their field of study (4.26 ± 0.75) (Figure 1). The participants also felt their teaching experience enhanced their academic/study skills (3.74 ± 0.97), motivated them to seek opportunities to improve/expand their teaching experience (3.61 ± 0.99), made them realize that they would like a career with some aspect of teaching (3.61 ± 1.14), improved their time management (3.55 ± 0.94), and enhanced their writing skills (3.38 ± 0.89). In an independent yet similar study by Coker and Van Dyke (2005) undergraduate botany students reported a greater appreciation for teaching and reported similar improvements in various skill sets as a result of their teaching experience. Although graduate students in the current study held a positive view of their teaching experience, they held a slightly negative view when asked if teaching enhanced their ability to conduct research (2.66 ± 1.01) or if it impeded their ability to complete or carry out their research (3.12 ± 1.04; Figure 1). This viewpoint may be due to the time demands teaching has in addition to graduate students' research requirements. In this survey, 79%, 46%, and 13% reported devoting at least three hours, ten hours, and 15 hours per week, respectively, to their teaching responsibilities. This is often in addition to time spent in the lab conducting research as part of a research assistantship and time required for the students to perform research for their own thesis or dissertation. When asked the open ended question "What do you dislike the most about your teaching experience?" 34% mentioned the time commitment of teaching or time taken way from research.

Summary

With faculty at large research institutions devoting much of their time to research, the role of graduate students as primary instructors and teaching assistants will continue to grow. In this study, students overwhelmingly held a positive view of their teaching responsibilities and recognized improvements in other aspects of their education and development as a result of their teaching experience. Setting up and leading laboratory exercises as well as grading course work were the most common tasks performed by graduate students. However, doctoral students were generally given greater responsibilities as they were more likely to develop course objectives, syllabi, and lecture presentations compared to students pursuing a master's degree. Although students felt prepared for their teaching

Table 5. Graduate student perceptions of their teaching experience and academic environment

	Overall[z]		Ph.D		M.S.	
	Avg	SD	Avg	SD	Avg	SD
I am interested in teaching	4.17	0.89	4.54	0.64	3.96	0.96
My college/university is supportive and rewards teaching	3.42	1.01	3.59	0.97	3.33	1.03
My department is supportive and rewards teaching	3.38	1.06	3.48	1.12	3.33	1.03
My advisor is supportive of my interest in teaching	4.05	0.86	4.33	0.73	3.90	0.90

[z] N = 76 overall; N = 27 for Ph.D. students; N = 49 for M.S. students.

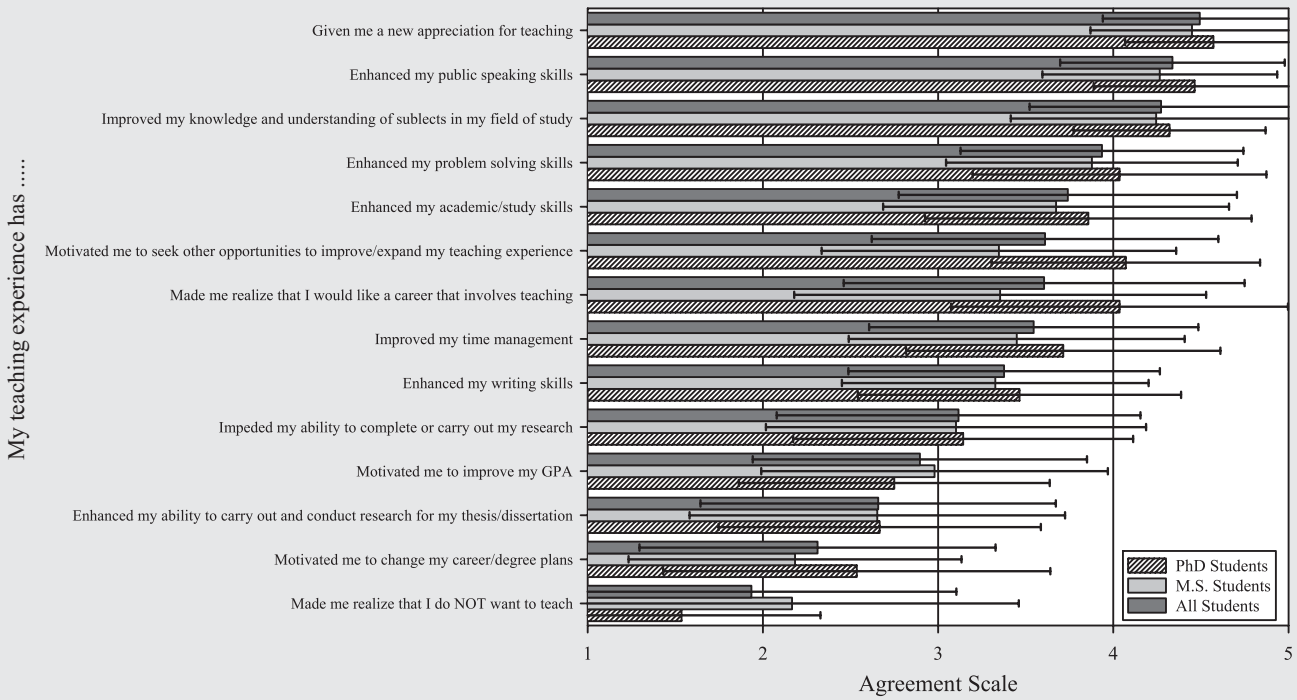

Figure 1. Graduate student perceptions of their teaching experience based on the following agreement scale: 1 – strongly disagree, 2 – disagree, 3 – neutral, 4 – agree, 5 – strongly agree. Error bars represent standard deviation. N = 76 overall; N = 27 for Ph.D. students; N = 49 for M.S. students

responsibilities, the apparent lack of pedagogical training may prevent these students from having a competitive advantage when seeking academic teaching positions. Despite the lack of training, students surveyed were motivated to seek opportunities to improve and develop their teaching skills outside of university, college, and/or department training sessions. With the number of institutions hiring faculty with heavy teaching responsibilities greatly outnumbering institutions with significant research responsibilities, there is a glaring need to prepare graduate students for non-research careers. The results of this study illustrate the significance of incorporating college teaching skills into the development and training of graduate students.

Literature Cited

AACU, 1985. Integrity in the college curriculum: A report to the academic community. Washington, DC: Association of American Colleges and Universities.

Adams, K.A. 2002. What colleges and universities want in new faculty. Preparing Future Faculty Occasional Paper, Number 7. Washington D.C., Association of American Colleges and Universities.

Anderson, R.D. and C.P. Mitchener. 1994. Research on science teacher education. In D.L. Gabel (Ed.), Handbook of research on science teaching and learning. New York, NY: Macmillan.

Anderson, M.S. and J.P. Swazey. 1998. Reflections on the graduate student experience: An overview. In M.S. Anderson (Ed.), The experience of being in graduate school: An exploration. New Directions for Higher Education, No. 101. San Francisco, CA: Jossey-Bass.

Austin, A.E. and D.H. Wulff. 2004. The challenge to prepare the next generation of future faculty. In D.H. Wulff and A.E. Austin (Eds). Paths to the professoriate: Strategies for enriching the preparation of future faculty. San Francisco, CA, Jossey-Bass.

Bomotti, S. 1994. Teaching assistant attitudes toward college teaching. Rev. of Higher Education 17(4): 371-393.

Boyer, E. 1990. Scholarship reconsidered: Priorities of the professoriate. Princeton, N.J., Carnegie Foundation for the Advancement of Teaching.

Campbell, S.P., A.K. Fuller, and D.A. Patrick. 2005. Looking beyond research in doctoral education. Frontiers in Ecology and the Environment 3(3): 153-160.

Carroll, J.G. 1980. Effects of training programs for university teaching assistants: A review of empirical research. Jour. of Higher Education 51: 167-183.

Croker, J.S. and C.G. Van Dyke. 2005. Evaluation of teaching and research experiences undertaken by botany majors at N.C. State University, North American Colleges and Teachers of Agriculture Jour. 49(1):14-19.

Dembo, M. and S. Gibson. 1985. Teacher's sense of efficacy: An important factor in school improvement. Elementary School Journal 86(2): 173-184.

Evans, E. and M. Tribble. 1986. Perceived teaching problems, self-efficacy, and commitment to teaching among preservice teachers. Jour. of Educational Research 80(2): 81-85.

Fairweather, J.S. and R.A. Rhoads. 1995. Teaching and the faculty role: Enhancing the commitment to instruction in American colleges and universities. Educational Evaluation and Policy Analysis 17(2): 179-194.

Gaia, A.C., D.P. Corts, H.E. Tatum, and J. Allen. 2003. The GTA mentoring program: An interdisciplinary approach to developing future faculty as teacher-scholars. College Teaching 51(2): 61-65.

Golde, C.M. and T.M. Dore. 2001. At cross purposes: What the experiences of doctoral students reveal about doctoral education (www.phd-survey.org), Philadelphia, P.A., A report prepared for the Pew Charitable Trusts.

Gray, P. and N. Buerkel-Rothfuss. 1991. Teaching assistant training: A view from the trenches. In J.D. Nyquist, R.D. Abbott, D.H. Wulff, and J. Sprague (Eds.), Preparing the professorate of tomorrow to teach. Dubuque, IA: Kendall/Hunt 40-51.

Hammrich, P.L. 2001. Preparing graduate teaching assistants to assist biology faculty. Jour. of Science Teacher Education 12: 67-82.

Luft, J.A., J.P. Kurdziel, G.H. Roehrig, and J. Turner. 2004. Growing a garden without water: Graduate teaching assistants in introductory science laboratories at a doctoral/research university. Jour. of Research in Science Teaching 41(3): 211-233.

National Association of Graduate-Professional Students (NAGPS). 2001. The 2000 national doctoral program survey. http://survey.nagps.org/. Accessed 10 June 2006.

National Center for Education Statistics (NCES). 2007. National Study of postsecondary faculty (NSOPF: 04). Digest of education statistics. NCES #2007-017.

Nerad, M. and J. Cerny. 1999. Postdoctoral patterns, career advancement, and problems. Science 285: 1533-1535.

Nyquist, J.D., B.J. Woodford, and D.L. Rogers. 2004. Re-envirioning the PhD: A challenge for the twenty-first century. In. D.H. Wuff and A.E. Austin (Eds). Paths to the professoriate: Strategies for enriching the preparation of future faculty. San Francisco, CA, Jossey-Bass.

Prieto L.R. and E.M. Altmaier. 1994. The relationship of prior training and previous teaching experience to self-efficacy among graduate teaching assistants. Research in Higher Education 35(4): 481-497.

Rushin, J.W., J. De Saix, A. Lumsden, D.P. Streubel, G. Summers, and C. Berson. 1997. Graduate teaching assistant training: A basis for improvement of college biology teaching and faculty development? American Biology Teacher 59: 86-90.

Schönwetter, D.J., L. Sokal, M. Friesen, and K.L. Taylor. 2002. Teaching philosophies reconsidered: A conceptual model for the development and evaluation of teaching philosophy statements. The International Jour. for Academic Development 7(1): 83-97.

Seldin, P. 1998. The teaching portfolio: A practical guide to improved performance and promotion/tenure decisions. 2nd ed., Bolton, MA. Anker.

Shannon, D.M., D.J. Twale, and M.S. Moore. 1998. TA teaching effectiveness: The impact of training and teaching experience. The Jour. of Higher Education 69(4): 440-466.

Sharpe, R. 2000. A framework for training graduate teaching assistants. Teacher Development 4(1): 131-143.

Sheatsley, P.B. 1983. Questionnaire construction and item writing. p. 195-230. In P.H. Rossi et al. (ed.) Handbook of survey research. New York, Academic Press.

Sykes, C.J. 1988. ProfScam: Professors and the demise of higher education. Washington D.C., Regnery Gateway.

Thien, S.J. 2003. A teaching-learning trinity: Foundation to my teaching philosophy. Jour. of Natural Resources and Life Science Education 32: 87-92.

Trautmann, N.M. and M.E. Krasny. 2006. Integrating teaching and research: A new model for graduate education? Bioscience 56(2): 159-165.

Travers, P.L. 1989. Better training for teaching assistants. College Teaching 37: 147-149.